THE JOURNAL OF AGRICULTURAL SCIENCE

EDITED BY

R. B. AUSTIN, D.SC., Plant Breeding Institute, Cambridge

B. W. BACHE, M.A., PH.D., C.CHEM., F.R.S.C., Macaulay Institute for Soil Research, Aberdeen

PROF. SIR J. W. L. BEAMENT, SC.D., F.R.S., Department of Applied Biology, Cambridge

G. D. H. BELL, C.B.E., PH.D., SC.D.(*h.c.*), D.SC.(*h.c.*), F.R.S., 6 Worts Causeway, Cambridge

SIR K. L. BLAXTER, PH.D., N.D.A. (HONS.), D.SC., F.R.S.E., F.R.S., Rowett Research Institute, Bucksburn, Aberdeen

PROF. A. D. CARE, D.SC., M.R.C.V.S., Department of Animal Physiology and Nutrition, Leeds

J. A. CURRIE, PH.D., Rothamsted Experimental Station, Harpenden

S. K. ELTRINGHAM, PH.D., Department of Applied Biology, Cambridge

PROF. J. L. JINKS, C.B.E., D.SC., F.I.BIOL., F.R.S., Department of Genetics, Birmingham

D. B. LINDSAY, B.SC., M.A., D.PHIL., Agricultural Research Council, Institute of Animal Physiology, Babraham, Cambridge

PROF. J. B. OWEN, B.SC., PH.D., M.A., Department of Agriculture, Bangor

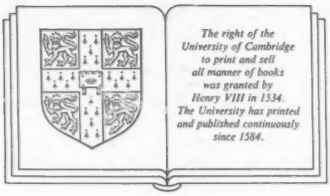
W. J. RIDGMAN, M.A., Department of Applied Biology, Cambridge

PROF. E. W. RUSSELL, C.M.G., D.SC., F.INST.P., Department of Soil Science, University of Reading

F. YATES, C.B.E., SC.D., F.R.S., Rothamsted Experimental Station, Harpenden

VOLUME 102

CAMBRIDGE UNIVERSITY PRESS
CAMBRIDGE
LONDON NEW YORK NEW ROCHELLE
MELBOURNE SYDNEY
1984



PUBLISHED BY

THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE

The Pitt Building, Trumpington Street, Cambridge CB2 1RP
32 East 57th Street, New York, N.Y.10022

© Cambridge University Press 1984

Printed in Great Britain at the University Press, Cambridge

Contents

PART 1 (FEBRUARY 1984)

PAGE

RUNDLE, H. L., CALCROFT, MARIAN and HOLT, C. An assessment of accumulation of Cd, Cr, Cu, Ni and Zn in the tissues of British Friesian steers fed on the products of land which has received heavy applications of sewage sludge 1

PAL, U. R., MURARI, K. and MALIK, H. S. Yield response of sorghum cultivars to inorganic nitrogen fertilizer 7

OLLERENSHAW, J. H. and HAYCOCK, R. Variation in the low temperature growth and frost tolerance of natural genotypes of *Trifolium repens* L. from Britain and Norway . . 11

CHAPMAN, J. F., DANIELS, R. W. and SCARISBRICK, D. H. Field studies on ^{14}C assimilate fixation and movement in oil-seed rape (*B. napus*) 23

JOHN, A. and ULYATT, M. J. Measurement of protozoa, using phosphatidyl choline, and bacteria, using nucleic acids, in the duodenal digesta of sheep fed chaffed lucerne hay (*Medicago sativa* L.) diets 33

JOHN, A. Effects of feeding frequency and level of feed intake on chemical composition of rumen bacteria 45

PATTERSON, H. D. and WEATHERUP, S. T. C. Statistical criteria for distinctness between varieties of herbage crops 59

BENJAMIN, L. R. The relative importance of some sources of root-weight variation in a carrot crop 69

CHAUDHARY, M. R. and AGGARWAL, G. C. A simple technique to evaluate the effect of mechanical stress on root growth 79

MAHEY, R. K. and CHEEMA, S. S. Evaluating methods of nitrogen application for efficiency of water use and yield of rainfed barley 81

ELLIS, R. P. and RUSSELL, G. Plant development and grain yield in spring and winter barley 85

WOOLFORD, M. K. and WILKIE, ANN C. Investigations into the role of specific micro-organisms in the aerobic deterioration of maize silage 97

BUTLER-HOGG, B. W. Growth patterns in sheep: wool growth during weight loss and subsequent compensatory growth 105

EL ATTAL, Z. M., MOUSTAFA, OMAYMA K. and DIAB, SAMIHA A. Influence of foliar fertilizers on the toxicity and tolerance to some insecticides in the cotton leafworm . . . 111

MOUSTAFA, OMAYMA K., EL ATTAL, Z. M. and DOBAN, AMAL F. The role of foliar fertilizers in tolerance of the cotton leafworm to certain insecticides 115

ROBINSON, DOROTHY L. A study of sequential variety selection systems 119

CLUTTERBUCK, B. J. and HODGSON, D. R. Direct drilling and shallow cultivation compared with ploughing for spring barley on a clay loam in northern England 127

BRAITHWAITE, G. D. Changes in phosphorus metabolism of sheep in response to the increased demands for P associated with an intravenous infusion of calcium 135

FINCH, VIRGINIA A., BENNETT, I. L. and HOLMES, C. R. Coat colour in cattle: effect on thermal balance, behaviour and growth, and relationship with coat type 141

LOUDON, A. S. I., DARROCH, A. D. and MILNE, J. A. The lactation performance of red deer on hill and improved species pastures 149

PAGE

GERRITSE, R. G. and VRIESEMA, R. Phosphate distribution in animal waste slurries . . 159

GORDON, F. J. The effect of level concentrate supplementation given with grass silage during the winter on the total lactation performance of autumn-calving dairy cows . . 163

BROWN, N. J. and NORTH, P. F. Tillage under controlled conditions: its effect on emergence and yield of spring barley 181

FRISCH, J. E., O'NEILL, C. J. and BURROW, H. M. The incidence and effect of poisoning with *Lantana camara* in different cattle breeds 191

WALKEY, D. G. A. and PINK, D. A. C. Resistance in vegetable marrow and other *Cucurbita* spp. to two British strains of cucumber mosaic virus 197

HUNTER, E. A., GLASBEY, C. A. and NAYLOR, R. E. L. The analysis of data from germination tests 207

SHARMA, K. N., SINGH, BIJAY, RANA, D. S., KAPUR, M. L. and SODHI, J. S. Changes in soil fertility status as influenced by continuous cropping and fertilizer application . . 215

ADAMS, S. N. Some effects of lime, nitrogen and soluble and insoluble phosphate on the yield and mineral composition of established grassland 219

ILORI, J. O. The effect of different proportions of protein and antibiotic in the diet on reproductive performance of indigenous pigs in Nigeria 227

SHORT NOTES

MAXWELL, W. M. C., BUTLER, L. G. and WILSON, H. R. Intra-uterine insemination of ewes with frozen semen 233

CHAUHAN, R. P. S., CHAUHAN, C. P. S. and CHAUHAN, S. K. Effect of boronated saline irrigation water on linseed 237

OLOGHOBO, A. D. and FETUGA, B. L. Haemagglutinin extracts from raw, sprouting and differently processed limabeans 241

PRASAD, J. and RAM, H. Varietal response to rhizobial strains for nodule character, chlorophyll and protein content in green gram (*Vigna radiata*) 245

HAILE, A. A study of the effects of oak defoliation on understory plants 247

HAILE, A. Effect of stage of maturity of forage oats on crude protein content and dry-matter yield 251

SINGH, B. and BADHORIA, B. S. Response of green gram to potassium and zinc application. 253

PART 2 (APRIL 1984)

THOMAS, D. and DE ANDRADE, R. P. The persistence of tropical grass–legume associations under grazing in Brazil 257

EBERSOHN, J. P. and MOIR, K. W. Effect of pasture growth rate on live-weight gain of grazing beef cattle 265

BILASPURI, G. S. and GURAYA, S. S. Histochemical localization of enzymes of various metabolic pathways in the testes of buffaloes, goats and rams 269

SPEEDY, A. W., BLACK, W. J. M. and FITZSIMONS, J. The effects of timing of management actions on the performance of a grassland sheep flock 275

SINGH, V. P., SINGH, M. and KAIRON, M. S. Physiological maturity in *Aestivum* wheat: visual determination 285

DROUSHIOTIS, D. N. The effect of variety and harvesting stage on forage production of barley in a low-rainfall environment 289

PAGE

BRAITHWAITE, G. D. Some observations on phosphorus homoeostasis and requirements of sheep 295

SHARMA, R. C., SAHOTA, T. S., SHARMA, U. C. and SHARMA, A. K. Phosphorus economy in potato cultivation by soaking mother seed tubers in a solution of urea and phosphate . 307

TALBOT, M. Yield variability of crop varieties in the U.K. 315

WOOLLEY, J. N. and EVANS, ALICE M. The use of two mating systems in breeding for resistance to *Maruca testulalis* Gey. in cow pea *Vigna unguiculata* (L.) Walp. 323

HAYCOCK, R. Dry-matter distribution and seasonal yield changes in five contrasting genotypes of white clover 333

INNES, P., BLACKWELL, R. D. and QUARRIE, S. A. Some effects of genetic variation in drought-induced abscisic acid accumulation on the yield and water use of spring wheat 341

CHESTNUTT, D. M. B. Effect of weight change on the performance of autumn-calving suckler cows 353

YADAV, R. L., MOHAN, R., SINGH, R. and VERMA, R. K. The effect of application of nitrogen fertilizer on the growth of opium poppy in north central India 361

HEYS, VIVIENNE and HILL, R. The selenium concentration of cereal grain and conserved and fresh herbage from farms in England and Wales 367

WEIR, A. H., BRAGG, P. L., PORTER, J. R. and RAYNER, J. H. A winter wheat crop simulation without water or nutrient limitations 371

PORTER, J. R. A model of canopy development in winter wheat 383

GANESHAMURTHY, A. N. and BISWAS, C. R. Movement of potassium in an Ustochrept soil profile in a long-term fertilizer experiment 393

RAI, R. and PRASAD, V. Studies on growth and symbiotic nitrogen fixation of *Rhizobium* of *Vigna radiata* under stress conditions 399

CRISP, P. Factors causing small curds in cauliflower crops 405

MCGOWAN, M., BLANCH, P., GREGORY, P. J. and HAYCOCK, D. Water relations of winter wheat. 5. The root system and osmotic adjustment in relation to crop evaporation . 415

WICKHAM, LYNDA D., PASSAM, H. C. and WILSON, L. A. Dormancy responses to post-harvest application of growth regulators in *Dioscorea* species. 1. Responses of bulbils, tubers and tuber pieces of three *Dioscorea* species 427

WICKHAM, LYNDA D., PASSAM, H. C. and WILSON, L. A. Dormancy responses to post-harvest application of growth regulators in *Dioscorea* species. 2. Dormancy responses in ware tubers of *D. alata* and *D. esculenta* 433

WICKHAM, LYNDA D., PASSAM, H. C. and WILSON, L. A. Tuber development, storage and germination in yams (*Dioscorea* spp.) in response to pre-harvest application of plant growth regulators 437

PHIPPS, R. H., MCALLAN, A. B. and WELLER, R. F. The development of plant components in isogenic sterile and fertile forage maize and their effects on carbohydrate composition, nutritive value, *in vivo* digestibility values and animal performance with fresh and ensiled crops 443

MYTTON, L. R. and HUGHES, D. M. Inoculation of white clover with different strains of *Rhizobium trifolii* on a mineral hill soil 455

FINCH-SAVAGE, W. E. Effects of fluid drilling germinating onion seeds on seedling emergence and subsequent plant growth 461

PHILLIPS, M. S. and POWELL, W. The effect of natural selection on composite cross populations of oats (*Avena sativa*) grown at contrasting sites in Scotland 469

PAGE

SEKHON, H. S., KAUL, J. N. and DHINGRA, K. K. Effect of *Rhizobium* inoculation, mulch and nitrogen and phosphorus fertilizers on soya bean (*Glycine max* (L.) Merrill) . . . 475

BARRY, T. N., MANLEY, T. R. and DUNCAN, S. J. Quantitative digestion by sheep of carbohydrates, nitrogen and S-methyl-L-cysteine sulphoxide in diets of fresh kale (*Brassica oleracea*) 479

LOWE, H. J. B. The assessment of populations of the aphid *Sitobion avenae* in field trials . 487

SHORT NOTES

PRAKASA RAO, E. V. S., SINGH, MUNNU, GANESHA RAO, R. S. and RAJESWARA RAO, B. R. Intercropping studies in geranium (*Pelargonium graveolens* L. Her. *ex* Ait) . . . 499

LINDBERG, J. E., KASPERSSON, A. and CISZUK, P. Studies on pH, number of protozoa and microbial ATP concentrations in rumen-incubated nylon bags with different pore sizes 501

BHATIA, V. S., BHARGAVA, S. C. and SINHA, S. K. Effect of irrigation on reproductive efficiency of bunch and spreading types of groundnut (*Arachis hypogaea* L.) 505

MCARDLE, R. N. The relationship of number and position of seeds to fruit size and curvature in *Capsicum annuum* L. 509

PART 3 (JUNE 1984)

JOHNSON, E. R. and VIDYADARAN, M. K. Prediction of beef carcass composition from organs and tissues of the non-carcass parts 511

BEN-GHEDALIA, D. and MIRON, J. The digestibility of wheat straw treated with sulphur dioxide 517

RAI, R., PRASAD, V. and SHULKA, I. C. Interaction between finger millet (*Eleusine coracana*) genotypes and drug-resistant mutants of *Azospirillum brasilense* in calcareous soil . 521

SINCLAIR, D. F. and GLEESON, A. C. On the analysis of replacement series diallel experiments 531

CANNELL, R. Q., GOSS, M. J., HARRIS, G. L., JARVIS, M. G., DOUGLAS, J. T., HOWSE, K. R. and LE GRICE, S. A study of mole drainage with simplified cultivation for autumn-sown crops on a clay soil. 1. Background, experiment and site details, drainage systems, measurement of drainflow and summary of results, 1978–80 539

HARRIS, G. L., GOSS, M. J., DOWDELL, R. J., HOWSE, K. R. and MORGAN, P. A study of mole drainage with simplified cultivation for autumn-sown crops on a clay soil. 2. Soil water regimes, water balances and nutrient loss in drain water, 1978–80 561

ELLIS, F. B., CHRISTIAN, D. G., BRAGG, P. L., HENDERSON, F. K. G., PREW, R. D. and CANNELL, R. Q. A study of mole drainage with simplified cultivation for autumn-sown crops on a clay soil. 3. Agronomy, root and shoot growth of winter wheat, 1978–80 . 583

WALTERS, D. E. and ROWELL, J. G. A missing value technique for the analysis of data with repeated measurements on each experimental unit 595

ECONOMIDES, S. Calcium metabolism in dairy sheep 601

LENG, R. A., NOLAN, J. V., CUMMING, G., EDWARDS, S. R. and GRAHAM, C. A. The effects of monensin on the pool size and turnover rate of protozoa in the rumen of sheep . . 609

DOWKER, B. D., HOROBIN, J. F., CROWTHER, T. C. and FENNELL, J. F. M. Breeding of improved open-pollinated populations of spring-sown onions 615

SMITH, M. W. Effect of postnatal development and weaning upon the capacity of pig intestinal villi to transport alanine 625

BARRY, T. N., MANLEY, T. R., MILLAR, K. R. and SMITH, R. H. The relative feeding value of kale (*Brassica oleracea*) containing normal and low concentrations of S-methyl-L-cysteine sulphoxide (SMCO) 635

ULYATT, M. J., WAGHORN, G. C., JOHN, A., REID, C. S. W. and MONRO, J. Effect of intake and feeding frequency on feeding behaviour and quantitative aspects of digestion in sheep fed chaffed lucerne hay 645

SAKAL, R., SINGH, A. P., SINGH, B. P. and SINHA, R. B. Evaluation of some chemical extractants for predicting response of wheat grown in pots to copper in Sub-Himalayan soils 659

ASHBELL, G., THEUNE, H. H. and SKLAN, D. Changes in amino acid compounds of wheat plants during ensiling and aerobic exposure: the influence of propionic acid and urea phosphate–calcium propionate 667

EASSON, D. L. The timing of nitrogen application for spring barley 673

JENKYN, J. F. and FINNEY, M. E. Experiments to examine the significance of ammonia evolution from barley seedlings infected with the powdery mildew fungus, *Erysiphe graminis* f.sp. *hordei* 679

PAEZ, ALEJANDRA., HELLMERS, H. and STRAIN, B. R. Carbon dioxide enrichment and water stress interaction on growth of two tomato cultivars 687

ROOKE, J. A., GREIFE, H. A. and ARMSTRONG, D. G. The effect of *in sacco* rumen incubation of a grass silage upon the total and D-amino acid composition of the residual silage dry matter 695

HUTCHINGS, N. J. The availability of nitrogen in liquid sewage sludges applied to grassland 703

RICHARDS, J. I. and LAWRENCE, P. R. The estimation of energy expenditure from heart rate measurements in working oxen and buffalo 711

HALL, I. R. Effect of inoculant endomycorrhizal fungi on white clover growth in soil cores. 719

HALL, I. R. Field trials assessing the effect of inoculating agricultural soils with endomycorrhizal fungi 725

WURR, D. C. E. and FELLOWS, JANE R. The growth of three crisp lettuce varieties from different sowing dates 733

SHORT NOTE

BUNTING, L. D., RICHARDSON, C. R. and TOCK, R. W. Digestibility of ozone-treated sorghum stover by ruminants 747